NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Land Reclamation

Toxic Discharge Control

(Number)

Code 455

DEFINITION

Control of acid or otherwise toxic aqueous discharges from abandoned coal mines or mine waste.

PURPOSES

To improve water quality, eliminate unsightly residues and odors and restore areas to beneficial use.

CONDITIONS WHERE PRACTICE APPLIES

To locations where acid or toxic drainage is degrading water quality, and/or the environment in and adjacent to streams, lakes, reservoirs or wetlands.

CRITERIA

Acid results form the oxidation of pyrite (and perhaps other sulfide minerals) exposed to air by the mining operation and subsequently taken into solution by percolating water. Other toxins may be present as trace elements in the sulfides or may be dissolved by the acid water.

There are four primary methods for controlling toxic mine drainage: (1) Mine sealing, (2) Infiltration control, (3) “Daylighting”, and (4) Neutralization.

Mine sealing. Mine sealing is usually employed to promote inundation by water of underground mine workings so as to reduce or prevent oxidation of pyritic materials.

Seals have also been used to prevent the entrance of air or water into the underground mine. In the inundation process, physical barriers are constructed in a mine opening to prevent the passage of water out of the mine. These seals must be designed to withstand maximum expected hydrostatic heads and be constructed of suitable materials such as masonry, concrete, grouted limestone, or clay. The double-bulkhead grouted aggregated seal has been the most successful and appears capable of withstanding large amounts of water pressure; up to 35 feet of head. Sealing mines to reduce acid mind drainage by constructing wet seals at the mouths of mine portal drainways to provide air locks while allowing water to discharge has been tried in the past with little success.

Infiltration control. Infiltration control is designed to reduce the amount of water entering underground mines and subsequently reducing the amount of drainage exiting the mine and thus reduce the pollution load. This procedure involves increasing surface runoff by correcting subsidence depressions, regrading the area to increase surface velocities, surface sealing of boreholes and fracture zones, and constructing dry masonry and/or clay seals to decrease surface flows entering the underground mines. Because of unknown subsurface fracture zones or the

condition of the overburden, coal outcrop, or highway, infiltration controls may prove to be ineffective or too costly. Gob piles and cast overburden can be reshaped for better surface drainage and blanketed with compacted, low permeability material to deter infiltration. Diversions may be used to reduce overflow. If infiltration cannot be effectively stopped, blanketing with pulverized limestone before topsoiling and revegetation may be effective in increasing the pH of the infiltration which inhibits the growth of Ferrobacillus and Thipbacillus organisms, thereby greatly reducing acid formation.

"Daylighting". Daylighting is performed by surface mining the existing underground coal, selectively placing toxic materials, regrading and vegetating the area, and diverting water to natural drainageways. This procedure has proven to be the most successful method of abating toxic mine drainage delivered form abandoned underground mines to receiving streams.

Neutralization. Acid or other toxic mine drainage water can be treated and neutralized by the addition of alkaline material to the mine drainage. By properly selecting the alkaline agent, many metal cations can be removed during neutralization as insoluble hydroxides. Several alkaline materials are available such as hydrated lime (Ca OH), caustic soda (Na OH), and limestone.

Alkaline mine drainage having a relatively high pH, in excess of 6.5, and containing predominantly iron cations can be successfully treated by aeration and/or hydrogen peroxide.

Although most of the undesirable metal cations are removed during neutralization, the product water is considered hard and requires additional treatment for potable use. If a proper sludge settling basin is provided after neutralization, the product water would not be detrimental to most fish and wildlife. Treatment is the least desirable because of the long-term nature of the action and the excessive operations and maintenance cost involved.

CONSIDERATIONS

1. Geological environment of the immediate area including characteristics of overburden such as lithology, faults, joints, and attitude.
2. Surface and subsurface hydrologic conditions.
3. Mining history.
4. Land use.
5. Post-mining history and conditions.
6. Topography.
7. Spatial and stratigraphic location of pyrites and other sulfides.
8. Availability of limestone or other alkaline material.
9. Availability of blanketing material.

Water Quantity

1. Effects on the water budget, especially on volume and rates of runoff, infiltration, evaporation, transpiration, deep percolation, flow through soil openings, and ground water recharge.
2. Variability of effects caused by seasonal and climatic conditions.
3. Effects of vegetation on soil moisture.
4. Effects on downstream flows or aquifers that would affect other water uses or users.
5. The effects of the potential changes on the established water regime on and near the site.
6. The effect on the water table of the area that could increase the hydraulic head sufficiently to force underground water to the surface in some less suitable site.

Water Quality

1. Effects on erosion and the movement of sediment, pathogens, soluble and sediment attached substances, and other deleterious materials carried by runoff or translocated by seepage water.
2. Effects on the visual quality of onsite and downstream water resources.
3. Short-term and construction-related effects of this practices on the quality of downstream water.

4. Potential for uncovering or redistributing toxic and low productive soil material.
5. Effects on the movement of dissolved substances below the root zone toward ground water.
6. The effects on wetland and water-related wildlife habitats.

PLANS AND SPECIFICATIONS

Plans and specifications for controlling toxic mine and refuse discharges shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

All disturbed areas shall be reshaped and regraded to blend with surrounding features. Visual resources must be considered in the installation. Exposed earth shall be covered with soil materials and established to vegetation or protected by other means. Access roads must be maintained and foot and vehicular traffic controlled. Sites must be monitored to determine the effectiveness of the work. Water sampling and pH reading should be taken at regular intervals until a steady state is established.